NORTH AMERICAN RUSTS ON CYPERUS AND ELEOCHARIS[1]

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The rusts inhabiting the species of the genus *Carex* have received considerable attention from both taxonomic and cultural viewpoints. The most recent accounts recognize in North America twenty-three species of *Carex* rusts, four with 1-celled teliospores (*Uromyces* or *Nigredo* type)[2] and nineteen with 2-celled teliospores (*Puccinia* or *Dicaeoma* type).[3] The rusts of other sedges have been studied much less carefully. Although *Cyperus* and *Eleocharis* are smaller and less variable genera than *Carex* it has not seemed reasonable that their rust flora should be so much more meager in North America as to consist of but three species on the two genera, yet this has been the generally accepted situation up to the present time. All specimens of rust on *Cyperus* have been called *Puccinia Cyperi* or *P. canaliculata,* these names being considered synonymous, while on *Eleocharis* 1-celled teliosporic forms have been called *Uromyces Eleocharidis,* and 2-celled forms *Puccinia Eleocharidis.*

Cyperus is a genus of about 600 species with a considerable distribution in the tropics whereas the genus *Carex* has something over 1,000 species chiefly distributed in temperate regions. *Eleocharis* is a much smaller genus. It is made up of about 140 species, rather widely distributed.

With the facts in mind as to the relative importance of the genera *Cyperus* and *Eleocharis* it was anticipated that a careful study of their rusts would reveal the presence of some additional

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[2] North American Flora 7: 234–236. 1912.

[3] Mycologia 9: 205–238. 1917.

species. There have been available about 300 collections (211 on *Cyperus* and 82 on *Eleocharis*) from the United States, Mexico, Central America, and the West Indies. Advantage was taken of an opportunity during the spring of 1918, to work in the Arthur Herbarium, Purdue University Agricultural Experiment Station, and the facilities provided by Professor H. S. Jackson, the advice of Dr. J. C. Arthur, and the aid rendered by several assistants, particularly Misses Evelyn Allison and Grace Wineland, and Mr. H. R. Rosen, have been in a large measure responsible for the results attained. Especial thanks are due Mr. Rosen for painstaking microscopic studies which were of the greatest value in defining the limits of the species. Type specimens of the new species are in the Arthur Herbarium.

About a dozen species of rust have been described on *Cyperus*. Five species are recognized in this paper. Four of the several possible names are applicable and one new name is proposed. Some of the established names are included in the synonomy and four are excluded. They either represent species not in our range or sufficient information is lacking to permit a proper disposition. An annotated list of these is included. No 1-celled teliosporic form has been described on *Cyperus*. Fewer species of rust have been described on *Eleocharis*. In North America we have known two, as many more are described here. Much culture work needs to be done. Only two of the nine species have their aecial stages known and two are known in the uredinial stage only.

KEY

HOSTS BELONGING TO GENUS CYPERUS (OR KYLLINGA).

Urediniospore-pores 2, equatorial.

Urediniospore-wall 1–2 μ thick, uniform.

1. *Puccinia canaliculata.*

Urediniospore-wall 1.5–2.5 μ thick, frequently thicker above.

2. *Puccinia Cyperi-tagetiformis.*

Urediniospore-pores usually 3 (in occasional spores 4 or 2), equatorial.

Urediniospore-wall 1.5 μ, or less, thick.

Urediniospore-wall nearly colorless, teliospore-wall 1.5–3 μ above.

3. *Puccinia antioquiensis.*

Urediniospore-wall cinnamon-brown, teliospore-wall 3–5 μ above.

4. *Puccinia abrepta.*

Urediniospore-wall 1.5–2 μ thick, teliospore-wall 7–12 μ above.

5. *Puccinia Cyperi.*

HOST BELONGING TO GENUS ELEOCHARIS.

Teliospores 2-celled.

Urediniospore-pores 2, equatorial.

Urediniospores small, 13–21 × 18–27 μ. 6. *Puccinia liberta.*

Urediniospores large, 18–26 × 27–37 μ. 7. *Uredo incomposita.*

Urediniospore-pores usually 4 (in occasional spores 3 or 5), equatorial. 8. *Puccinia Eleocharidis.*

Teliospores 1-celled. 9. *Uromyces Eleocharidis.*

1. PUCCINIA CANALICULATA (Schw.) Lagerh. Trömso Mus. Aarsh. 17: 51. 1894

Sphaeria canaliculata Schw. Trans. Am. Phil. Soc. II. 4: 209. 1832.

Aecidium compositarum Xanthii Ellis, N. Am. Fungi *1018b.* 1883.

Aecidium compositarum Ambrosiae Burrill; DeToni, in Sacc. Syll. Fung. 7: 798. 1888.

Aecidium compositarum Xanthii Burrill; DeToni, in Sacc. Syll. Fung. 7: 799. 1888.

Puccinia cellulosa B. & C.; Cooke, in Grevillea 20: 108. 1892.

Uredo ustulata B. & C.; Cooke, in Grevillea 20: 110, hyponym. 1892.

Puccinia nigrovelata Ellis & Tracy; Ellis & Ev. in Bull. Torrey Club 22: 60. 1895.

Dicaeoma canaliculatum Kuntze, Rev. Gen. 3^3 466. 1898.

Dicaeoma nigrovelata Kuntze, Rev. Gen. 3^3: 469. 1898.

O. Pycnia amphigenous, gregarious, in small compact groups, honey-yellow becoming brownish, inconspicuous, globoid, 112–128 μ in diameter; ostiolar filaments up to 35 μ or more long.

I. Aecia chiefly hypophyllous, in orbicular or elongated groups 2–5 mm. or more across, on larger discolored spots or on swollen areas on the stems, cupulate, low, 0.2–0.3 mm. in diameter; peridium delicate, the margin finely eroded and slightly recurved; peridial cells rhomboidal, 23–29 μ long, slightly overlapping, the outer wall thick, 5–8 μ, striate, the inner wall thinner, 2–4 μ, verrucose; aeciospores globoid, often angular, 13–16 by 15–19 μ; the wall thin, 1 μ or less, finely verrucose.

ON AMBROSIACEAE:

Ambrosia trifida L., Indiana, Missouri.

Xanthium sp., Arkansas, Delaware, Indiana, Iowa, New Mexico, Pennsylvania.

II. Uredinia chiefly hypophyllous, scattered, oblong, 0.5–2 mm. long, tardily dehiscent by longitudinal slits, ruptured epidermis conspicuous, somewhat pulverulent, cinnamon-brown; urediniospores broadly ellipsoid or obovoid, 13–19 by 19–29 μ; the wall yellowish or cinnamon-brown, 1–2 μ thick, moderately and finely echinulate; the pores 2, equatorial.

III. Telia chiefly hypophyllous, scattered or more often confluent in groups 1–3 mm. or more long, individual sori linear, 0.1 mm. or less in width and surrounded by well developed brownish stroma, blackish or grayish-black, long covered by the epidermis, not or only slightly raised above the leaf surface; teliospores clavate-oblong, 15–21 by 39–64 μ, acuminate, obtuse or rounded above, narrowed below, slightly or not constricted at septum; the wall dark cinnamon-brown, lighter toward base, about 1 μ thick, much thicker above, 3–10 μ; pedicel short, tinted.

ON CYPERACEAE:

Cyperus cylindricus (Ell.) Britton (*C. Torreyi* Britton), Delaware.

Cyperus esculentus L., California, District of Columbia, Florida, Indiana, Kansas, Michigan, Nebraska, New Jersey, New Mexico, Oklahoma, Texas; Mexico (state), Toluca.

Cyperus fendlerianus Boeckl., New Mexico.

Cyperus ferax L. C. Rich, Cuba; Porto Rico.

Cyperus giganteum Vahl, Porto Rico.

Cyperus Hallii Britton, Missouri.

Cyperus Houghtonii Torrey, Nebraska, Wisconsin.

Cyperus Mutisii (H.B.K.) Griseb., Jamaica.

Cyperus reticulatus L., Porto Rico.

Cyperus rotundus L., Florida, Kansas.

Cyperus seslerioides H.B.K., Mexico (state).

Cyperus speciosus Vahl, Kansas.

Cyperus strigosus L., Alabama, Delaware, Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Mississippi, Nebraska, New York, Oklahoma, Pennsylvania, Virginia, West Virginia.

Cyperus surinamensis Rottb. (?), Texas; Cuba.

Cyperus thyrsiflorus Jung. (?), Mexico (state).

Cyperus sp., Colorado, North Carolina, Guatemala; Oaxaca.

Type locality: Bethlehem, Pennsylvania, on *Cyperus* sp.

Distribution: New York to Michigan and Nebraska south through Mexico, Central America and the West Indies.

Exsiccati: Barth. Fungi Columb. *2449, 2758, 4260;* Barth. N. Am. Ured. *136, 137, 233, 337, 839, 1038, 1430, 1637;* Carleton, Ured. Am. *10;* Ellis, N. Fungi *1018b;* Ellis & Ev. Fungi Columb. *552, 983, 1760, 2144, 2146;* Ellis & Ev. N. Am. Fungi *3143, 3352;* Seym. & Earle, Econ. Fungi *393*.

A comparison of the types of *Puccinia canaliculata* Schw. and *P. Cyperi* Arth. shows clearly that they are distinct species. The presence of a strongly developed stroma in the telia of *P. canaliculata* and a lack of a similar development in *P. Cyperi* is one of the most conspicuous differences. There are also other distinguishing characters in the telia. In *P. canaliculata* the telia are not much raised above the surface and the epidermis does not rupture noticeably whereas in the other species the telia are pulvinate and the ruptured epidermis becomes conspicuous. Important differences in the urediniospores particularly in size of the spores and arrangement of pores help to make the separation of the two species unquestionable. This is the only *Cyperus* rust which has been cultured. For record of first cultures see Journal of Mycology **12**: 23. 1906.

2. **Puccinia Cyperi-tagetiformis** (P. Henn.) comb. nov.

Uredo Cyperi-tagetiformis P. Henn. Engler's Bot. Jahrb. **34**: 598. 1905.

O and I. Pycnia and aecia unknown.

II. Uredinia hypophyllous and culmicolous, scattered, oblong, 0.5–2 mm. long, tardily dehiscent by longitudinal slits, bullate, finely pulverulent, cinnamon-brown; urediniospores broadly ellipsoid or slightly obovoid, 15–21 by 19–26 μ; the wall dark cinnamon-brown or somewhat lighter, 1.5–2.5 μ thick, frequently thicker and lighter at apex, up to 3 μ, verrucose or verrucose-echinulate, the markings more pronounced above, the pores 2, equatorial.

III. Telia chiefly hypophyllous, most often confluent in groups 1–4 mm. or more long, individual sori linear, about 0.1 mm. in width, surrounded by well developed brownish stroma, blackish-brown, long covered by the epidermis, not much raised above the

leaf surface; teliospores clavate-oblong, 14–18 by 31–48 μ acuminate, obtuse or rounded above, narrowed below, slightly constricted at septum; the wall golden or light cinnamon-brown, about 1 μ thick, much thicker above, 6–10 μ; pedicel short, slightly tinted.

ON CYPERACEAE:

Cyperus distans L., Porto Rico.
Cyperus flavicomus Michx., Texas.
Cyperus laevigatus L., Porto Rico.
Cyperus odoratus L., Cuba; Porto Rico.
Cyperus polystachys Rottb., Porto Rico.
Cyperus radiatus Vahl, Porto Rico.
Cyperus sphacelatus Rottb., Porto Rico.
Cyperus surinamensis Rottb., Porto Rico.

Type locality: Kamodamura, Tosa, Japan, on *Cyperus tagetiformis.*

Distribution: Southeastern Texas and the West Indies.

When described this species was known in the uredinial stage only. Teliospores have been found since which are of the 2-celled type. The urediniospore-pore arrangement is similar to the preceding species but the thicker walls of the urediniospores which are frequently thicker and lighter at the apex are very distinctive characters. Except for a single specimen from Texas the distribution in our range is limited to Porto Rico.

3. PUCCINIA ANTIOQUIENSIS Mayor, Mem. Soc. Neuch. Sci. Nat. 5: 473. 1913

O and I. Pycnia and aecia unknown.

II. Uredinia amphigenous and caulicolous, scattered, small, punctiform or somewhat oblong, long covered by the epidermis; urediniospores broadly ellipsoid or obovoid, 14–19 by 18–26 μ; the wall nearly colorless or pale yellow, thin, about 1 μ minutely and sparsely echinulate; the pores obscure, apparently 3, equatorial.

III. Telia caulicolous or hypophyllous, scattered, rounded or slightly elongated, long covered by the epidermis, finally dehiscent and somewhat pulverulent; teliospores clavate-oblong, 11–16 by 35–50 μ, rounded, truncate or somewhat acuminate at apex, attenuate at base, slightly or not constricted at septum; the wall

golden- or light cinnamon-brown, paler below, very thin, about 1 μ, thicker at apex, 1.5–5 μ, smooth; pedicel about half length of spore, slightly tinted.

ON CYPERACEAE:

Cyperus diffusus Vahl, Panama.

Type locality: Antioquia, Columbia, on *Cyperus diffusus*.

Distribution: Panama; also in South America.

Puccinia antioquiensis as described by Mayor from Columbia is a decidedly characteristic species. The pale thin walls of both urediniospores and teliospores, and the slight thickness at the apex of the teliospores, put the species in a class by itself. Our specimen from Panama is on the same host as the type specimen and agrees perfectly in all respects.

4. **Puccinia abrepta** sp. nov.

O and I. Pycnia and aecia unknown.

II. Uredinia hypophyllous, scattered, oval or oblong, 0.3–1 mm. long, somewhat bullate, rather tardily naked, ruptured epidermis conspicuous, cinnamon-brown; urediniospores ellipsoid or obovoid, 16–19 by 23–26 μ; the wall cinnamon-brown, 1–1.5 μ thick, moderately or sparsely echinulate; the pores 3, equatorial, covered with a swollen hyaline cuticle.

III. Telia not seen; teliospores narrowly ellipsoid or oblong, 13–16 by 27–45 μ, rounded above and slightly narrowed below, somewhat constricted at septum; the wall light cinnamon-brown, thin, 1 μ or less, thicker above, 3–5 μ, smooth; pedicel about one-half length of spore, tinted.

ON CYPERACEAE:

Cyperus ferax L. C. Rich, Costa Rica.

Type collected at San Jose, Costa Rica, Jan. 8, 1916, *E. W. D. Holway 385*.

Distribution: Known only from the type locality.

The specimen here used as the basis of a new species differs from *Puccinia antioquiensis* in the darker, thicker-walled urediniospores and in the thicker apex of the teliospores. It differs from *Puccinia Cyperi* particularly in the smaller size of the urediniospores and in the thinner apex of the teliospores. The host of the

type was determined by P. C. Standley. The specimen was reported by Arthur in the Costa Rican list of Uredinales as *P. canaliculata*.[4]

5. PUCCINIA CYPERI Arth. Bot. Gaz. **16**: 226. 1891

Dicaeoma Cyperi Kuntze, Rev. Gen. 3^3: 466. 1898.

O and I. Pycnia and aecia unknown.

II. Uredinia chiefly hypophyllous, scattered, often very numerous, oblong, 0.3–1.5 mm. long, tardily dehiscent by longitudinal slits, somewhat bullate; urediniospores ellipsoid or obovoid, 18–24 by 24–35 μ; wall light cinnamon-brown, 1.5–2 μ thick, moderately and finely echinulate; the pores equatorial, usually 3, in occasional spores 4 or 2.

III. Telia chiefly hypophyllous, in groups 1.6 mm. long, or scattered, individual sori linear 0.1–0.2 mm. in width, with no or only slight development of stroma, somewhat tardily naked, dark chocolate-brown or blackish, pulvinate, ruptured epidermis conspicuous; teliospores broadly clavate-oblong, 18–26 by 35–61 μ, rounded or truncate above, narrowed below, slightly constricted at septum; wall chestnut-brown, paler below, about 1–1.5 μ thick, much thicker above, 7–12 μ, smooth; pedicel short, tinted.

ON CYPERACEAE:

Cyperus atropurpureus Liebm., Mexico (state).

Cyperus Buckleyi Britton, Michoacan.

Cyperus Buchii Britton, Kansas.

Cyperus cayennensis (Lam.) Britton, Cuba; Porto Rico.

Cyperus cylindricus (Ell.) Britton (*C. Torreyi* Britton), Alabama, Texas.

Cyperus filiculmis Vahl, Connecticut, Delaware, Indiana, Kansas, Massachusetts, Nebraska, New York, Oklahoma, Texas, West Virginia, Wisconsin.

Cyperus flavicomus L., Mexico (state).

Cyperus globosus Aubl. (*C. echinatus* Wood), Alabama.

Cyperus Grayi Torrey, New York.

Cyperus hermaphroditus (Jacq.) Standley, Guatemala.

Cyperus Houghtonii Torrey, Wisconsin.

Cyperus lancastriensis Porter, Delaware.

[4] See Mycologia **10**: 129. 1918.

Cyperus mutisii (H.B.K.) Griseb., Jamaica.
Cyperus ovularis (Michx.) Torrey, Alabama, Delaware, South Carolina.
Cyperus refractus Engelm., Delaware.
Cyperus retrofractus (L.) Torrey, Alabama.
Cyperus Schweinitzii Torrey, Illinois, Iowa, Indiana, Nebraska, Oklahoma, Wisconsin.
Cyperus spectabilis Scheb., Mexico (state), Morelos.
Cyperus strigosus L., Indiana, Missouri, New York.
Cyperus sp., North Carolina.
Kyllinga brevifolia Rottb., Porto Rico.
Kyllinga pumila Michx., Grenada; Porto Rico; Martinique; Vera Cruz.
Kyllinga odorata Vahl, Guatemala.

Type locality: Decorah, Iowa, on *Cyperus Schweinitzii.*

Distribution: Massachusetts, Wisconsin and Nebraska south through Mexico, Central America and the West Indies.

Exsiccati: Barth. N. Am. Ured. *542, 837, 838, 1436;* Ellis & Ev. Fungi Columb. *1850, 2145;* Ravenel, Fungi Am. *278, 498;* Sydow, Ured. *1016, 1017, 1177.*

Puccinia Cyperi has long been confused with *P. canaliculata* as explained in the note under that species. It is most certainly entitled to recognition. The list of hosts includes three species of *Kyllinga,* a comparatively small genus rather closely related to *Cyperus.*

6. **Puccinia liberta** sp. nov.

O and I. Pycnia and aecia unknown.

II. Uredinia chiefly culmicolous, scattered, usually numerous, oval or oblong, 0.3–1.5 mm. long, sometimes longer by becoming confluent, tardily dehiscent by longitudinal slits, somewhat bullate, slightly pulverulent after dehiscence; urediniospores broadly ellipsoid or obovoid, sometimes more or less laterally compressed, 13–21 by 18–27 μ; the wall golden- or cinnamon-brown, 1.5–2 μ thick, moderately and finely echinulate; the pores 2, equatorial.

III. Telia rare, only few seen, resembling uredinia in shape and size, darker in color, tardily dehiscent by longitudinal slits, compact; teliospores clavate-oblong or fusiform, 14–18 by 40–50 μ, rounded or acuminate above, usually narrowed below; the wall golden- or cinnamon-brown, often paler at apex, 1–1.5 μ thick, thicker above, 4–7 μ, smooth; pedicel short, tinted.

ON CYPERACEAE:

Eleocharis cellulosa Torrey, Porto Rico.
Eleocharis flaccida (Spr.) Urb., Porto Rico.
Eleocharis geniculatus (L.) R. Br., Cuba; Guatemala; Porto Rico.
Eleocharis montana (H.B.K.) R. & S., California.
Eleocharis mutata (L.) R. & S., Porto Rico.
Eleocharis sp., Nicaragua.

Type collected at Grenada, dept. Grenada, Nicaragua, on *Eleocharis* sp., Feb. 11, 1903, *C. F. Baker 2385*.

Distribution: The West Indies and Central America and in southern California.

The species here described differs from *Puccinia Eleocharidis* very markedly in urediniospore characters. The urediniospores are smaller, somewhat thicker-walled and possess 2 equatorial pores as compared with 3–5, usually 4, equatorial pores in *P. Eleocharidis*. The distribution is tropical or sub-tropical whereas *P. Eleocharidis* is chiefly a temperate region species. Judging from the size of the urediniospores and the arrangement of the pores *Puccinia liberta* appears to be the correlated form of *Uromyces Eleocharidis*. The type specimen is a part of a collection distributed by Baker as "Plants of Central America," and although somewhat fragmentary bears both uredinal and telial stages. There is a more ample specimen of the type collection at the N. Y. Botanical Garden.

7. **Uredo incomposita** sp. nov.

O and I. Pycnia and aecia unknown.

II. Uredinia chiefly culmicolous, scattered or sometimes in more or less evident groups, oval or oblong, 0.4–1.5 mm. or more long, tardily dehiscent by longitudinal slits, somewhat bullate; urediniospores broadly ellipsoid or obovoid, often somewhat angular, 18–26 by 27–37 μ; the wall golden- or cinnamon-brown, moderately echinulate, 1.5–2 μ thick; the pores 2, equatorial.

III. Telia not known.

ON CYPERACEAE:

Eleocharis geniculatus (L.) R. Br., Porto Rico.
Eleocharis interstincta (Vahl) R. & S., Porto Rico.
Eleocharis sp., Guatemala.

Type collected at Mayaguez, Porto Rico, on *Eleocharis interstincta,* May 20, 1916, *Whetzel & Olive 35.*

Distribution: Known only from Porto Rico and Guatemala.

No teliospores could be found on the specimens here cited as the foundation of a new species but the urediniospore structure is so characteristic that no other disposition seems satisfactory. The pore arrangement is like that of the preceding species but the spores are very much larger and although often somewhat angular are not laterally compressed. The host of the type specimen was determined by Dr. Britton. The collection was cited as *Puccinia Eleocharidis* by Arthur in the "Uredinales of Porto Rico based on collections by H. H. Whetzel and E. W. Olive."[5]

8. PUCCINIA ELEOCHARIDIS Arth. Bull. Iowa Agr. Coll. Dept. Bot. 1884: 156. 1884

Aecidium compositarum Eupatorii DeToni: in Sacc. Syll. Fung. 7: 798. 1888.

Dicaeoma Eleocharidis Kuntze, Rev. Gen. 3[2]: 468. 1898.

O. Pycnia amphigenous, few in small orbicular groups, punctiform, honey-yellow becoming reddish-brown, rather inconspicuous, globoid, 100–170 μ in diameter; ostiolar filaments 35–60 μ long.

I. Aecia hypophyllous, in crowded groups or in orbicular groups about the pycnia on discolored spots that are usually conspicuous, cupulate, low, 0.2–0.3 mm. in diameter; peridium delicate, the margin deeply lacerate and revolute; peridial cells rhomboidal, 24–34 μ long, the outer wall 4–6 μ thick, striate, the inner wall 2–3 μ, verrucose; aeciospores globoid, 16–21 by 18–24 μ; the wall colorless, about 1 μ thick, finely verrucose.

ON CARDUACEAE:

Eupatorium maculatum L., Indiana, Iowa, Nebraska, New York.

Eupatorium perfoliatum L., Delaware, Illinois, Iowa, Indiana, Kansas, Maine, Michigan, Nebraska, New York, Pennsylvania, Wisconsin; Nova Scotia, Ontario.

Eupatorium purpureum L., Alabama, Indiana, Iowa, Michi-

[5] See Mycologia 9: 76. 1917.

gan, Nebraska, New Jersey, New York, Pennsylvania, Wisconsin, Manitoba, Quebec.

Eupatorium rotundifolium L., Delaware, Mississippi.

Eupatorium serotinum Michx., Louisiana.

Eupatorium verbenaefolium Michx., Alabama.

II. Uredinia chiefly culmicolous, scattered, oblong, 0.3–1 mm. long, tardily dehiscent by longitudinal slits, somewhat bullate; uredinospores broadly ellipsoid or obovoid, 17–24 by 26–40 μ; the wall yellowish or light cinnamon-brown, about 1.5 μ thick, rather sparsely and finely echinulate; the pores equatorial, usually 4, in occasional spores 3 or 5.

III. Telia chiefly culmicolous, scattered, oblong, 0.5–1.5 mm. long, tardily dehiscent by longitudinal slits, somewhat bullate, blackish-brown; teliospores clavate-oblong, 13–19 by 32–65 μ, slightly or not constricted at septum, truncate, rounded, or obtuse above, somewhat narrowed at the base; the wall light chestnut-brown, paler below, smooth; about 1 μ thick, much thicker at apex, 3–7 μ; pedicel short, tinted.

ON CYPERACEAE:

Eleocharis capitata (L.) R. Br. (*Scirpus capitatus* L.), Cuba; Porto Rico.

Eleocharis intermedia (Muhl.) Schult., Iowa, New York, Pennsylvania.

Eleocharis obtusa (Willd.) Schult., Indiana, Oklahoma.

Eleocharis ovata (Roth) R. & S., New York, West Virginia.

Eleocharis palustris (L.) R. & S. (*E. glaucescens* Willd., *E. palustris glaucescens* A. Gray), Indiana, Iowa, Kansas, Michigan, Nebraska, Wisconsin; Ontario, Quebec.

Eleocharis tenuis (Willd.) Schult., Maine, Nebraska, New York.

Eleocharis sp., Texas, Virginia; Manitoba.

Type locality: Spirit Lake, Iowa, on *Eleocharis intermedia*.

Distribution: Maine and Quebec to Manitoba, south to the Gulf of Mexico, and in Cuba and Porto Rico, with aecia known only from the eastern United States and adjacent parts of Canada.

Exsiccati: Barth, Fungi Columb. *2355, 2759, 4144, 4662;* Barth, N. Am. Ured. *338, 840, 938, 1043, 1238;* Ellis, N. Am. Fungi *1419;* Ellis & Ev., Fungi Columb. *1458, 1802, 2147;* Griff., W.

Am. Fungi *330;* Shear, N. Y. Fungi *127;* Sydow, Ured. *2023, 2414, 2516.*

Puccinia Eleocharidis is the common 2-celled form on *Eleocharis.* It is the only species on this host which has been cultured. For record of first cultures see Journal of Mycology **12**: 23. 1906. It is interesting that the aecial distribution appears to be limited to a portion of the area covered by the uredinial and telial stages. This situation is of course entirely possible but on the other hand further collecting may alter the situation. The aecia on *Eupatorium* are often not conspicuous and may have been overlooked in the southern range of the species.

9. UROMYCES ELEOCHARIDIS Arthur, Bull. Torrey Club 33: 514. 1906

Nigredo Eleocharidis Arth. N. Am. Flora **7**: 232. 1912.

O and I. Pycnia and aecia unknown.

II. Uredinia amphigenous, scattered, oblong, 0.3–1.5 mm. long, tardily dehiscent by one or more longitudinal slits, dark cinnamon-brown; urediniospores ellipsoid to broadly ellipsoid, 15–19 by 19–29 μ; wall golden-yellow, thin, 1–1.5 μ, sparsely and finely echinulate, the pores 2, approximately equatorial.

III. Telia amphigenous, thickly scattered, oblong, 0.5–2 mm. or more long, tardily dehiscent by longitudinal slits, chocolate-brown; teliospores angularly obovoid, truncate or rounded above, narrowed below, 16–22 by 27–45 μ; wall light chestnut-brown, rather thin, 1–1.5 μ, thicker above, 7–10 μ, smooth; pedicel tinted, about once to once and a half length of spore.

ON CYPERACEAE:

Type locality: Aberdeen, South Dakota, on *Eleocharis palustris.*

Distribution: Northern Mississippi and Missouri basins.

Exsiccati: D. Griff., W. Am. Fungi *60, 60a;* Barth, Fungi Columb. *2293, 3291;* Sydow, Ured. *2102, 2252;* Brenckle, Fungi Dak. *50.*

EXCLUDED NAMES

Puccinia Romagnoliana Maire & Sacc. Ann. Myc. **1**: 220. 1903.

According to the Sydow Monograph this species is near *Puccinia Cyperi.* It is even suggested that it may be only the Euro-

pean form of our species. The teliospores differ materially, particularly in thickness of walls. The walls are 2–2.5 μ thick whereas all of our species on *Cyperus* have notably thin walls, none of them having walls more than 1.5 μ thick and for the most part they are 1 μ or less. The urediniospores have pores often above the equator, an arrangement not found in any of our species.

Puccinia conclusa Thüm. in Contr. Flor. Lusit. in Jour. d. sc. math. phys. e nat. Lisboa **24**: 10. 1878. From Coimbra, Portugal.

No specimen has been available; uredinia are not described.

Puccinia subcoronata P. Henn. Hedw. **34**: 94. 1895. From Goyaz, Brazil.

Apparently differs from our species in coronate condition of teliospores. Our specimen bearing this label does not appear to be authentic.

Uredo philippinensis Sydow, Ann. Myc. **4**: 32. 1906.

Has much smaller urediniospores than any of our species.

Uredo eleocharidicola Speg. Anal. Mus. Nac. Buenos Aires **6**: 237. 1899.

Resembles *Puccinia liberta* but is not identical.

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